

WEST Search History

DATE: Tuesday, April 05, 2005

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		<i>DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI; THES=ASSIGNEE; PLUR=YES; OP=ADJ</i>	
<input type="checkbox"/>	L10	L9 and particle size	22
<input type="checkbox"/>	L9	L8 and (synthetic boehmite or natural boehmite or pseudo near1 boehmite)	22
<input type="checkbox"/>	L8	L7 and (platinum or palladium or ruthenium or rhenium or silver or boron)	32
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<input type="checkbox"/>	L2	L1 and impregnat\$3 and calcinat\$3	81
<input type="checkbox"/>	L1	boehmite and synthesis gas same hydrocarbon\$1	143

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☐ 1. Document ID: US 20050054738 A1

Using default format because multiple data bases are involved.

L10: Entry 1 of 22

File: PGPB

Mar 10, 2005

PGPUB-DOCUMENT-NUMBER: 20050054738

PGPUB-FILING-TYPE: new

DOCUMENT-IDENTIFIER: US 20050054738 A1

TITLE: Chemically and thermally stabilized alumina for Fischer-Tropsch catalysts

PUBLICATION-DATE: March 10, 2005

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Fraenkel, Dan	Ponca City	OK	US	

US-CL-CURRENT: 518/716; 502/302

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KWIC	Draw D
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☐ 2. Document ID: US 20040214904 A1

L10: Entry 2 of 22

File: PGPB

Oct 28, 2004

PGPUB-DOCUMENT-NUMBER: 20040214904

PGPUB-FILING-TYPE: new

DOCUMENT-IDENTIFIER: US 20040214904 A1

TITLE: Attrition resistant gamma-alumina catalyst support

PUBLICATION-DATE: October 28, 2004

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Singleton, Alan H.	Baden	PA	US	
Oukaci, Rachid	Gibsonia	PA	US	
Goodwin, James G.	Cranberry Township	PA	US	

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	COUNTRY	TYPE	CODE
Sasol Technology (UK) Limited					02

APPL-NO: 10/ 851379 [PALM]
DATE FILED: May 21, 2004

RELATED-US-APPL-DATA:

Application 10/851379 is a continuation-of US application 09/844379, filed April 27, 2001, US Patent No. 6740621
Application 09/844379 is a division-of US application 09/316562, filed May 21, 1999, US Patent No. 6262132

INT-CL: [07] B01 J 33/00, C07 C 27/06

US-CL-PUBLISHED: 518/716; 502/351
US-CL-CURRENT: 518/716; 502/351

REPRESENTATIVE-FIGURES: NONE

ABSTRACT:

A method for reducing catalyst attrition losses in hydrocarbon synthesis processes conducted in high agitation reaction systems; a method of producing an attrition-resistant catalyst; a catalyst produced by such method; a method of producing an attrition-resistant catalyst support; and a catalyst support produced by such method. The inventive method of reducing catalyst attrition losses comprises the step of reacting a synthesis gas in a high agitation reaction system in the presence of a catalyst. In one aspect, the catalyst preferably comprises a .gamma.-alumina support including an amount of titanium effective for increasing the attrition resistance of the catalyst. In another aspect, the catalyst preferably comprises a .gamma.-alumina support which has been treated, after calcination, with an acidic, aqueous solution. The acidic aqueous solution preferably has a pH of not more than about 5. In another aspect, the catalyst preferably comprises cobalt on a .gamma.-alumina support wherein the cobalt has been applied to the .gamma.-alumina support by totally aqueous, incipient wetness-type impregnation. In another aspect, the catalyst preferably comprises cobalt on a .gamma.-alumina support with an amount of a lanthana promoter effective for increasing the attrition resistance of the catalyst. In another aspect, the catalyst preferably comprises a .gamma.-alumina support produced from boehmite having a crystallite size, in the 021 plane, in the range of from about 30 to about 55 .ANG.ngstrons. In another aspect, the inventive method of producing an attrition-resistant catalyst comprises the step of treating a .gamma.-alumina support, after calcination of and before adding catalytic material to the support, with an acidic solution effective for increasing the attrition resistance of the catalyst. In another aspect, the inventive method of producing an attrition-resistant catalyst support comprises the step of treating calcined .gamma.-alumina with an acidic, aqueous solution effective for increasing the attrition resistance of the .gamma.-alumina.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KWIC	Draw D
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☐ 3. Document ID: US 20040138060 A1

L10: Entry 3 of 22

File: PGPB

Jul 15, 2004

PGPUB-DOCUMENT-NUMBER: 20040138060
PGPUB-FILING-TYPE: new

DOCUMENT-IDENTIFIER: US 20040138060 A1 .

TITLE: Stabilized alumina supports, catalysts made therefrom, and their use in partial oxidation

PUBLICATION-DATE: July 15, 2004

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Rapier, Charles R.	Ponca City	OK	US	
Xie, Shuibo	Ponca City	OK	US	
Hu, Baili	Ponca City	OK	US	
Ortego, Beatrice C.	Ponca City	OK	US	
Simon, David E.	Bartlesville	OK	US	
Minahan, David M.	Stillwater	OK	US	

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	COUNTRY	TYPE CODE
ConocoPhillips Company	Houston	TX		02

APPL-NO: 10/ 706645 [PALM]
DATE FILED: November 12, 2003

RELATED-US-APPL-DATA:

Application is a non-provisional-of-provisional application 60/501185, filed September 8, 2003,
Application is a non-provisional-of-provisional application 60/425381, filed November 11, 2002,
Application is a non-provisional-of-provisional application 60/425383, filed November 11, 2002,

INT-CL: [07] B01 J 23/10

US-CL-PUBLISHED: 502/302; 423/651
US-CL-CURRENT: 502/302; 423/651

REPRESENTATIVE-FIGURES: NONE

ABSTRACT:

The present invention relates to stabilized supports stable at temperatures above 800.degree. C., and method of preparing such supports, which includes adding a rare earth metal to an aluminum-containing precursor prior to calcining. The present invention can be more specifically seen as a support, process and catalyst wherein the stabilized alumina catalyst support comprises a rare earth aluminate with a molar ratio of aluminum to rare earth metal greater than 5:1 and, optionally, an aluminum oxide. More particularly, the invention relates to the use of catalysts comprising rhodium, ruthenium, iridium, or combinations thereof, loaded onto said stabilized supports for the synthesis gas production via partial oxidation of light hydrocarbons, and further relates to gas-to-liquids conversion processes.

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims the benefit of 35 U.S.C. 111(b) U.S. Provisional Application Serial No. 60/425,381 filed Nov. 11, 2002, entitled "Novel Syngas Catalysts and Their Method of Use", U.S. Provisional Application Serial No. 60/425,383 filed Nov. 11, 2002, entitled "Improved Supports for High Surface Area Catalysts" and U.S. Provisional Application Serial No. 60/501,185 filed Sep. 8, 2003, entitled "Stabilized Alumina Supports, Catalysts Made Therefrom, And Their Use in Partial Oxidation and which are hereby incorporated by reference herein for all purposes.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KWAC	Drawings
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☐ 4. Document ID: US 20040132834 A1

L10: Entry 4 of 22

File: PGPB

Jul 8, 2004

PGPUB-DOCUMENT-NUMBER: 20040132834

PGPUB-FILING-TYPE: new

DOCUMENT-IDENTIFIER: US 20040132834 A1

TITLE: Fischer-tropsch processes and catalysts using stabilized supports

PUBLICATION-DATE: July 8, 2004

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Ortego, J. Dale	Ponca City	OK	US	
Jothimurugesan, Kandaswamy	Ponca City	OK	US	
Espinoza, Rafael L.	Ponca City	OK	US	
Coy, Kevin L.	Ponca City	OK	US	
Ortego, Beatrice C.	Ponca City	OK	US	

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	COUNTRY	TYPE CODE
ConocoPhillips Company	Houston	TX		02

APPL-NO: 10/ 687022 [PALM]

DATE FILED: October 16, 2003

RELATED-US-APPL-DATA:

Application is a non-provisional-of-provisional application 60/419003, filed October 16, 2002,

INT-CL: [07] C07 C 27/06

US-CL-PUBLISHED: 518/718

US-CL-CURRENT: 518/718

REPRESENTATIVE-FIGURES: NONE

ABSTRACT:

A catalyst and method for producing hydrocarbons using a catalyst support having an improved hydrothermal stability, such as under Fischer-Tropsch synthesis conditions. The stabilized support is made by a method comprising treating a boehmite material in contact with at least one structural stabilizer. Contacting the boehmite with at least one structural stabilizer can include forming a mixture comprising the boehmite material and at the least one structural stabilizer. The mixture can be a sol or a slurry. The treating preferably includes drying or spray drying the mixture, and calcining in an oxidizing atmosphere to obtain the stabilized support. Preferred structural stabilizers can include an element, such as cobalt, magnesium, zirconium, boron, aluminum, barium, silicon, lanthanum, oxides thereof, or combinations thereof; or can include precipitated oxides, such as a co-precipitated silica-alumina.

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This non-provisional application claims the benefit of U.S. Provisional Application No. 60/419,003, filed Oct. 16, 2002, which is hereby incorporated by reference in its entirety.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KWIC	Draw. Data
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☐ 5. Document ID: US 20040132833 A1

L10: Entry 5 of 22

File: PGPB

Jul 8, 2004

PGPUB-DOCUMENT-NUMBER: 20040132833

PGPUB-FILING-TYPE: new

DOCUMENT-IDENTIFIER: US 20040132833 A1

TITLE: Fischer-Tropsch processes and catalysts made from a material comprising boehmite

PUBLICATION-DATE: July 8, 2004

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Espinoza, Rafael L.	Ponca City	OK	US	
Jin, Yaming	Ponca City	OK	US	
Jothimurugesan, Kandaswamy	Ponca City	OK	US	
Srinivasan, Nithya	Ponca City	OK	US	

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	COUNTRY	TYPE CODE
ConocoPhillips Company	Houston	TX		02

APPL-NO: 10/ 686977 [PALM]

DATE FILED: October 16, 2003

RELATED-US-APPL-DATA:

Application is a non-provisional-of-provisional application 60/419073, filed October 16, 2002,

INT-CL: [07] C07 C 27/06

US-CL-PUBLISHED: 518/718

US-CL-CURRENT: 518/718

REPRESENTATIVE-FIGURES: 6

ABSTRACT:

A hydrothermally-stable catalyst, method for making the same, and process for producing hydrocarbon, wherein the catalyst is used in synthesis gas conversion to hydrocarbons. In one embodiment, the method comprises depositing a compound of a catalytic metal selected from Groups 8, 9, and 10 of the Periodic Table on a support material comprising boehmite to form a composite material; and calcining the composite material to form the catalyst. In other embodiments, the support material comprises synthetic boehmite, natural boehmite, pseudo-boehmite, or combinations thereof.

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This non-provisional application claims the benefit of U.S. Provisional Application No. 60/419,073, filed Oct. 16, 2002, which is hereby incorporated by reference in its entirety.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	WMC	Draw De
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☐ 6. Document ID: US 20040132832 A1

L10: Entry 6 of 22

File: PGPB

Jul 8, 2004

PGPUB-DOCUMENT-NUMBER: 20040132832

PGPUB-FILING-TYPE: new

DOCUMENT-IDENTIFIER: US 20040132832 A1

TITLE: Supports for high surface area catalysts

PUBLICATION-DATE: July 8, 2004

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Espinoza, Rafael L.	Ponca City	OK	US	
Fraenkel, Dan	Ponca City	OK	US	
Coy, Kevin L.	Ponca City	OK	US	

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	COUNTRY	TYPE CODE
ConocoPhillips Company	Houston	TX	US	02

APPL-NO: 10/ 706202 [PALM]

DATE FILED: November 12, 2003

RELATED-US-APPL-DATA:

Application is a non-provisional-of-provisional application 60/425383, filed November 11, 2002,

INT-CL: [07] C07 C 27/06, B01 J 23/00

US-CL-PUBLISHED: 518/716; 502/323

US-CL-CURRENT: 518/716; 502/323

REPRESENTATIVE-FIGURES: 1

ABSTRACT:

The present invention relates to thermally stable, high surface area alumina supports and a method of preparing such supports with at least one modifying agent. The method includes adding an aluminum modifying agent to the alumina prior to calcining. The inventive support has thermal stability at temperatures above 800.degree. C. A more specific embodiment of the invention is a catalyst having a high surface area, thermally stable alumina support with at least one group VIII metal or rhenium and an optional promoter loaded onto the support. The present invention further relates to gas-to-liquids conversion processes, more specifically for producing C.sub.5+ hydrocarbons.

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This non-provisional application claims the benefit of U.S. Provisional Application No. 60/425,383, filed Nov. 11, 2002, which is hereby incorporated by reference in its entirety.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	RU/NC	Draw D
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☐ 7. Document ID: US 20040127587 A1

L10: Entry 7 of 22

File: PGPB

Jul 1, 2004

PGPUB-DOCUMENT-NUMBER: 20040127587

PGPUB-FILING-TYPE: new

DOCUMENT-IDENTIFIER: US 20040127587 A1

TITLE: Method for forming a Fischer-Tropsch catalyst using a bohemite support material

PUBLICATION-DATE: July 1, 2004

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Espinoza, Rafael L.	Ponca City	OK	US	
Jothimurugesan, Kandaswamy	Ponca City	OK	US	
Jin, Yaming	Ponca City	OK	US	

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	COUNTRY	TYPE CODE
ConocoPhillips Company	Houston	TX		02

APPL-NO: 10/ 688412 [PALM]

DATE FILED: October 16, 2003

RELATED-US-APPL-DATA:

Application is a non-provisional-of-provisional application 60/419073, filed October 16, 2002,

INT-CL: [07] C07 C 27/06

US-CL-PUBLISHED: 518/715; 502/335

US-CL-CURRENT: 518/715; 502/335

REPRESENTATIVE-FIGURES: 1

ABSTRACT:

A method is provided for forming a highly active Fischer-Tropsch catalyst using boehmite having a particular crystallite size. In this method, a support material comprising boehmite is contacted with a catalytic metal-containing compound to form a catalyst precursor. The boehmite is selected to have an average crystallite size in the range of from about 6 nanometers (nm) to about 30 nm. An alternate embodiment uses a mixture of boehmites with various average crystallite sizes in the range of from about 4 nm to about 30 nm, differing by at least by 1 nm. Subsequently, the catalyst precursor is calcined to convert the boehmite to a stabilized aluminum oxide structure, thereby forming a catalyst support having a good attrition resistance and a relatively high hydrothermal stability.

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims benefit of priority from U.S. Provisional Application Serial No. 60/419,073, filed Oct. 16, 2002, and entitled "Hydrothermally Stable Catalyst and Method of Making Same," which is incorporated herein by reference.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KIMC	Draw. De
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☐ 8. Document ID: US 20040127352 A1

L10: Entry 8 of 22

File: PGPB

Jul 1, 2004

PGPUB-DOCUMENT-NUMBER: 20040127352

PGPUB-FILING-TYPE: new

DOCUMENT-IDENTIFIER: US 20040127352 A1

TITLE: High hydrothermal stability catalyst support

PUBLICATION-DATE: July 1, 2004

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Jin, Yaming	Ponca City	OK	US	
Espinoza, Rafael L.	Ponca City	OK	US	

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	COUNTRY	TYPE CODE
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ConocoPhillips Company Houston TX US 02

APPL-NO: 10/ 687017 [PALM]
DATE FILED: October 16, 2003

RELATED-US-APPL-DATA:

Application is a non-provisional-of-provisional application 60/419006, filed October 16, 2002,

INT-CL: [07] B01 J 23/56

US-CL-PUBLISHED: 502/332

US-CL-CURRENT: 502/332

REPRESENTATIVE-FIGURES: NONE

ABSTRACT:

Methods are disclosed for preparing hydrothermally-stable structurally-promoted refractory-oxide catalyst supports, which includes mixing precursors of the refractory oxide and of at least one structural promoter and calcining the mixture. The methods feature the incorporation of at least one structural promoter into the lattice of a refractory-oxide material such as alumina. The hydrothermally-stable structurally-promoted refractory-oxide catalyst supports are useful in hydrothermal catalytic processes such as Fischer-Tropsch reactions.

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This non-provisional application claims the benefit of U.S. Provisional Application No. 60/419,006, filed Oct. 16, 2002, which is hereby incorporated by reference in its entirety.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KWIC	Draw Da
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☐ 9. Document ID: US 20010036967 A1

L10: Entry 9 of 22

File: PGPB

Nov 1, 2001

PGPUB-DOCUMENT-NUMBER: 20010036967

PGPUB-FILING-TYPE: new

DOCUMENT-IDENTIFIER: US 20010036967 A1

TITLE: Attrition resistant fischer-tropsch catalyst and support

PUBLICATION-DATE: November 1, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Singleton, Alan H.	Baden	PA	US	
Oukaci, Rachid	Gibsonia	PA	US	
Goodwin, James G.	Cranberry Township	PA	US	

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	COUNTRY	TYPE	CODE
Energy International Corporation	Pittsburgh	PA			02

APPL-NO: 09/ 844379 [PALM]
DATE FILED: April 27, 2001

RELATED-US-APPL-DATA:

Application 09/844379 is a division-of US application 09/316562, filed May 21, 1999, US Patent No. 6262132

INT-CL: [07] C07 C 27/06

US-CL-PUBLISHED: 518/720

US-CL-CURRENT: 518/720

REPRESENTATIVE-FIGURES: NONE

ABSTRACT:

A method for reducing catalyst attrition losses in hydrocarbon synthesis processes conducted in high agitation reaction systems; a method of producing an attrition-resistant catalyst; a catalyst produced by such method; a method of producing an attrition-resistant catalyst support; and a catalyst support produced by such method. The inventive method of reducing catalyst attrition losses comprises the step of reacting a synthesis gas in a high agitation reaction system in the presence of a catalyst. In one aspect, the catalyst preferably comprises a .gamma.-alumina support including an amount of titanium effective for increasing the attrition resistance of the catalyst. In another aspect, the catalyst preferably comprises a .gamma.-alumina support which has been treated, after calcination, with an acidic, aqueous solution. The acidic aqueous solution preferably has a pH of not more than about 5. In another aspect, the catalyst preferably comprises cobalt on a .gamma.-alumina support wherein the cobalt has been applied to the .gamma.-alumina support by totally aqueous, incipient wetness-type impregnation. In another aspect, the catalyst preferably comprises cobalt on a .gamma.-alumina support with an amount of a lanthana promoter effective for increasing the attrition resistance of the catalyst. In another aspect, the catalyst preferably comprises a .gamma.-alumina support produced from boehmite having a crystallite size, in the 021 plane, in the range of from about 30 to about 55 .ANG.ngstrons. In another aspect, the inventive method of producing an attrition-resistant catalyst comprises the step of treating a .gamma.-alumina support, after calcination of and before adding catalytic material to the support, with an acidic solution effective for increasing the attrition resistance of the catalyst. In another aspect, the inventive method of producing an attrition-resistant catalyst support comprises the step of treating calcined .gamma.-alumina with an acidic, aqueous solution effective for increasing the attrition resistance of the .gamma.-alumina.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KWIC	Draw Da
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10. Document ID: US 20010031793 A1

L10: Entry 10 of 22

File: PGPB

Oct 18, 2001

PGPUB-DOCUMENT-NUMBER: 20010031793
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20010031793 A1

TITLE: Highly active fischer-tropsch catalyst having increased thermal stability

PUBLICATION-DATE: October 18, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Singleton, Alan H.	Baden	PA	US	
Oukaci, Rachid	Gibsonia	PA	US	

APPL-NO: 09/ 810790 [PALM]
DATE FILED: March 16, 2001

RELATED-US-APPL-DATA:

Application 09/810790 is a division-of US application 09/528163, filed March 17, 2000, US Patent No. 6255358

INT-CL: [07] C07 C 27/06, B01 J 23/40

US-CL-PUBLISHED: 518/715; 502/327

US-CL-CURRENT: 518/715; 502/327

REPRESENTATIVE-FIGURES: NONE

ABSTRACT:

A method of conducting hydrocarbon synthesis and a highly stable cobalt on alumina catalyst therefor. The inventive method comprises the step of reacting a synthesis gas in a slurry bubble column reactor in the presence of the catalyst. The catalyst comprises a .gamma.-alumina support doped with an amount of lanthana oxide, barium oxide, or a combination thereof effective for increasing the thermal stability of the catalyst in the slurry bubble column reacting system while maintaining or increasing the activity of the catalyst.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KIMC	Draw Da
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☐ 11. Document ID: US 20010003787 A1

L10: Entry 11 of 22

File: PGPB

Jun 14, 2001

PGPUB-DOCUMENT-NUMBER: 20010003787
PGPUB-FILING-TYPE: new-utility
DOCUMENT-IDENTIFIER: US 20010003787 A1

TITLE: Fischer-tropsch activity for "non-promoted" cobalt-on-alumina catalysts

PUBLICATION-DATE: June 14, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Singleton, Alan H.	Baden	PA	US	
Oukaci, Rachid	Gibsonia	PA	US	
Goodwin, James G.	Cranberry Township	PA	US	

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	COUNTRY	TYPE	CODE
Energy International Corporation	Pittsburgh	PA	US		02

APPL-NO: 09/ 742873 [PALM]
DATE FILED: December 20, 2000

RELATED-US-APPL-DATA:

Application 09/742873 is a division-of US application 09/320327, filed May 26, 1999, US Patent No. 6191066
Application is a non-provisional-of-provisional application 60/086846, filed May 27, 1998,

INT-CL: [07] C07 C 2/00, C07 C 1/00, C07 C 27/00, C07 C 27/06

US-CL-PUBLISHED: 585/700; 585/733, 518/700, 518/715
US-CL-CURRENT: 585/700; 518/700, 518/715, 585/733

REPRESENTATIVE-FIGURES: 1

ABSTRACT:

Cobalt catalysts, and processes employing these inventive catalysts, for hydrocarbon synthesis. The inventive catalyst comprises cobalt on an alumina support and is not promoted with any noble or near noble metals. In one aspect of the invention, the alumina support preferably includes a dopant in an amount effective for increasing the activity of the inventive catalyst. The dopant is preferably a titanium dopant. In another aspect of the invention, the cobalt catalyst is preferably reduced in the presence of hydrogen at a water vapor partial pressure effective to increase the activity of the cobalt catalyst for hydrocarbon synthesis. The water vapor partial pressure is preferably in the range of from 0 to about 0.1 atmospheres.

[0001] This application claims the benefit of U.S. provisional patent application Ser. No. 60/086,846, filed May 27, 1998.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	NOOC	Draw D
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☐ 12. Document ID: US 6740621 B2

L10: Entry 12 of 22

File: USPT

May 25, 2004

US-PAT-NO: 6740621

DOCUMENT-IDENTIFIER: US 6740621 B2

TITLE: Attrition resistant Fischer-Tropsch catalyst and support

DATE-ISSUED: May 25, 2004

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Singleton; Alan H.	Baden	PA		
Oukaci; Rachid	Gibsonia	PA		
Goodwin; James G.	Cranberry Township	PA		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Sasol Technology (UK) Limited	Sasolburg			ZA	03

APPL-NO: 09/ 844379 [PALM]

DATE FILED: April 27, 2001

PARENT-CASE:

This application is a divisional of application Ser. No. 09/316,562 filed May 21, 1999 now U.S. Pat. No. 6,262,132 B1.

INT-CL: [07] B01 J 20/02, B01 J 23/00, C01 F 7/20

US-CL-ISSUED: 502/429; 423/626, 423/628, 502/355

US-CL-CURRENT: 502/429; 423/626, 423/628, 502/355

FIELD-OF-SEARCH: 502/439, 502/355, 423/626, 423/628

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<u>3853789</u>	December 1974	Warthen et al.	252/463
<u>4102978</u>	July 1978	Kiovsky	423/626
<u>4179408</u>	December 1979	Sanchez et al.	252/448
<u>4315839</u>	February 1982	Bouge et al.	252/448
<u>4379134</u>	April 1983	Weber et al.	423/626
<u>4476245</u>	October 1984	Siefert	502/302
<u>4493905</u>	January 1985	Beuther et al.	502/325
<u>4681867</u>	July 1987	Dyer et al.	502/242
<u>4801573</u>	January 1989	Eri et al.	502/302
<u>4874732</u>	October 1989	Miller et al.	502/74
<u>5037791</u>	August 1991	Comolli et al.	502/185
<u>5334570</u>	August 1994	Beauseigneur et al.	502/304
<u>5939350</u>	August 1999	Singleton et al.	502/230
<u>6066308</u>	May 2000	Dupin et al.	423/659
<u>6365544</u>	April 2002	Herron et al.	502/326

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
WO 98/38147	September 1998	WO	
WO 99/01218	January 1999	WO	

ART-UNIT: 1754

PRIMARY-EXAMINER: Silverman; Stanley S.

ASSISTANT-EXAMINER: Strickland; Jonas N.

ATTY-AGENT-FIRM: Fellers, Snider, Blankenship, Bailey & Tippens, P.C.

ABSTRACT:

A catalyst support having improved attrition resistance and a catalyst produced therefrom. The catalyst support is produced by a method comprising the step of treating calcined .gamma.-alumina having no catalytic material added thereto with an acidic aqueous solution having an acidity level effective for increasing the attrition resistance of the calcined .gamma.-alumina.

18 Claims, 5 Drawing figures

Full	Title	Citation	Front	Review	Classification	Date	Reference				Claims	K00C	Draw D
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☐ 13. Document ID: US 6537945 B2

L10: Entry 13 of 22

File: USPT

Mar 25, 2003

US-PAT-NO: 6537945

DOCUMENT-IDENTIFIER: US 6537945 B2

TITLE: Highly active fischer-tropsch catalyst having increased thermal stability

DATE-ISSUED: March 25, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Singleton; Alan H.	Baden	PA		
Oukaci; Rachid	Gibsonia	PA		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE	CODE
Energy International Corporation	Pittsburgh	PA			02	

APPL-NO: 09/ 810790 [PALM]

DATE FILED: March 16, 2001

PARENT-CASE:

This application is a divisional of copending application Ser. No. 09/528,163 filed Mar. 17, 2000, U.S. Pat. No. 6,255,358 B1, issued Jul. 3, 2001.

INT-CL: [07] B01 J 23/40

US-CL-ISSUED: 502/327; 502/415, 502/439
US-CL-CURRENT: 502/327; 502/415, 502/439

FIELD-OF-SEARCH: 502/327, 502/303, 502/439, 502/414, 502/415

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<u>4088671</u>	May 1978	Kobylinski	260/449.6R
<u>4399234</u>	August 1983	Beuther et al.	518/715
<u>4493905</u>	January 1985	Beuther et al.	502/325
<u>4585798</u>	April 1986	Beuther et al.	518/715
<u>4670414</u>	June 1987	Kobylinski et al.	502/174
<u>4717702</u>	January 1988	Beuther et al.	502/303
<u>4822824</u>	April 1989	Iglesia et al.	518/709
<u>5023276</u>	June 1991	Yarrington et al.	514/703
<u>5140050</u>	August 1992	Mauldin et al.	518/715
<u>5145876</u>	September 1992	Shutt	518/715
<u>5292705</u>	March 1994	Mitchell	502/325
<u>5856365</u>	January 1999	Zennaro et al.	518/715
<u>5939350</u>	August 1999	Singleton et al.	502/230
<u>6100304</u>	August 2000	Singleton et al.	518/715
<u>6149799</u>	November 2000	Raybaud et al.	208/49
<u>6182443</u>	February 2001	Jarvis et al.	60/274
<u>6191066</u>	February 2001	Singleton et al.	502/332
<u>6262132</u>	July 2001	Singleton et al.	518/715
<u>6271432</u>	August 2001	Singleton et al.	585/700

ART-UNIT: 1754

PRIMARY-EXAMINER: Silverman; Stanley G.

ASSISTANT-EXAMINER: Nguyen; Cam N.

ATTY-AGENT-FIRM: Fellers, Snider, Blankenship, Bailey & Tippens

ABSTRACT:

A highly active Fischer-Tropsch catalyst having increased thermal stability. The catalyst comprises a .gamma.-alumina support doped with an amount of lanthana oxide, barium oxide, or a combination thereof effective for increasing the thermal stability of the catalyst in a slurry bubble column reaction system while maintaining or increasing the activity of the catalyst for Fischer-Tropsch synthesis.

6 Claims, 2 Drawing figures

Full	Title	Citation	Front	Review	Classification	Date	Reference			Claims	KMIC	Draws	Doc
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☐ 14. Document ID: US 6271432 B1

L10: Entry 14 of 22

File: USPT

Aug 7, 2001

US-PAT-NO: 6271432

DOCUMENT-IDENTIFIER: US 6271432 B1

TITLE: Fischer-tropsch activity for non-promoted cobalt-on-alumina catalysts

DATE-ISSUED: August 7, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Singleton; Alan H.	Baden	PA		
Oukaci; Rachid	Gibsonia	PA		
Goodwin; James G.	Cranberry Township	PA		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Energy International	Pittsburgh	PA			02

APPL-NO: 09/ 742873 [PALM]

DATE FILED: December 20, 2000

PARENT-CASE:

This application is a divisional of application Ser. No. 09/320,327 filed May 26, 1999, now U.S. Pat. No. 6,191,066, which claims the benefit of U.S. Provisional Application Ser. No. 60/086,846, filed May 27, 1998.

INT-CL: [07] C07 C 2/00, C07 C 1/00, C07 C 4/00, C07 C 27/06, C07 C 27/00

US-CL-ISSUED: 585/700; 585/733, 518/700, 518/715

US-CL-CURRENT: 585/700; 518/700, 518/715, 585/733

FIELD-OF-SEARCH: 585/700, 585/733, 518/700, 518/715

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<u>2393909</u>	January 1946	Johnson	260/449.6
<u>2515245</u>	July 1950	Mattox	252/417

ART-UNIT: 175

PRIMARY-EXAMINER: Bell; Mark L.

ASSISTANT-EXAMINER: Hailey; Patricia L.

ATTY-AGENT-FIRM: Fellers, Snider, Blankenship, Bailey & Tippens

ABSTRACT:

Cobalt catalysts, and processes employing these inventive catalysts, for hydrocarbon synthesis. The inventive catalyst comprises cobalt on an alumina support and is not promoted with any noble or near noble metals. In one aspect of the invention, the alumina support preferably includes a dopant in an amount effective for increasing the activity of the inventive catalyst. The dopant is preferably a titanium dopant. In another aspect of the invention, the cobalt catalyst is preferably reduced in the presence of hydrogen at a water vapor partial pressure effective to increase the activity of the cobalt catalyst for hydrocarbon synthesis. The water vapor partial pressure is preferably in the range of from 0 to about 0.1 atmospheres.

13 Claims, 2 Drawing figures

Full	Title	Citation	Front	Review	Classification	Date	Reference			Claims	KWIC	Draw D
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☐ 15. Document ID: US 6262132 B1

L10: Entry 15 of 22

File: USPT

Jul 17, 2001

US-PAT-NO: 6262132

DOCUMENT-IDENTIFIER: US 6262132 B1

TITLE: Reducing fischer-tropsch catalyst attrition losses in high agitation reaction systems

DATE-ISSUED: July 17, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Singleton; Alan H.	Baden	PA		
Oukaci; Rachid	Gibsonia	PA		
Goodwin; James G.	Cranberry Township	PA		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Energy International Corporation	Pittsburgh	PA			02

APPL-NO: 09/ 316562 [PALM]

DATE FILED: May 21, 1999

INT-CL: [07] C07 C 27/00, B01 J 23/00, B01 J 23/40

US-CL-ISSUED: 518/715; 518/700, 502/303, 502/309, 502/314, 502/326

US-CL-CURRENT: 518/715; 502/303, 502/309, 502/314, 502/326, 518/700

FIELD-OF-SEARCH: 518/715, 518/700, 502/303, 502/309, 502/314, 502/326

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<u>2393909</u>	January 1946	Johnson	
<u>2515245</u>	July 1950	Mattox	
<u>2540109</u>	February 1951	Friedman	
<u>2544574</u>	March 1951	Walker et al.	
<u>2598186</u>	May 1952	Mayland	
<u>2605234</u>	July 1952	Friedman	
<u>2608568</u>	August 1952	Hogan et al.	
<u>2620313</u>	December 1952	Odell	
<u>2632015</u>	March 1953	Kratzer	
<u>2635110</u>	April 1953	Watson	
<u>2661338</u>	December 1953	Lanning	
<u>2662912</u>	December 1953	Martin	
<u>2735802</u>	February 1956	Jahnig	
<u>2775607</u>	December 1956	Kolbel et al.	
<u>2852350</u>	September 1958	Kolbel et al.	
<u>3617517</u>	November 1971	Rashkin	
<u>3669904</u>	June 1972	Cornelius et al.	
<u>3943052</u>	March 1976	Kmak et al.	
<u>3966586</u>	June 1976	Owen et al.	
<u>3988263</u>	October 1976	Hansford	
<u>4079072</u>	March 1978	Finch	
<u>4088671</u>	May 1978	Kobyliniski	
<u>4089811</u>	May 1978	Koniz et al.	
<u>4090949</u>	May 1978	Owen et al.	
<u>4133841</u>	January 1979	Maule et al.	
<u>4207208</u>	June 1980	Lucki et al.	
<u>4208191</u>	June 1980	Sze	
<u>4218388</u>	August 1980	Schaper et al.	
<u>4219445</u>	August 1980	Finch	
<u>4235754</u>	November 1980	Chester	
<u>4252736</u>	February 1981	Haag et al.	
<u>4260518</u>	April 1981	Katzer et al.	
<u>4279830</u>	July 1981	Haag et al.	
<u>4385193</u>	May 1983	Bijwaard et al.	
<u>4403044</u>	September 1983	Post et al.	
<u>4423265</u>	December 1983	Chu et al.	
<u>4433065</u>	February 1984	van der Burgt et al.	
<u>4477595</u>	October 1984	Madon	
<u>4493905</u>	January 1985	Beuther et al.	
<u>4499209</u>	February 1985	Hoek et al.	
<u>4507400</u>	March 1985	Miller et al.	
<u>4523047</u>	June 1985	Chester et al.	

<u>4548912</u>	October 1985	Hettinger et al.
<u>4565831</u>	January 1986	Wright et al.
<u>4567205</u>	January 1986	Arcuri et al.
<u>4585798</u>	April 1986	Beuther et al.
<u>4595703</u>	June 1986	Payne et al.
<u>4605676</u>	August 1986	Kobylinski et al.
<u>4605678</u>	August 1986	Brennan et al.
<u>4606811</u>	August 1986	Hettinger
<u>4619910</u>	October 1986	Dyer et al.
<u>4637993</u>	January 1987	van Erp
<u>4663305</u>	May 1987	Mauldin et al.
<u>4670472</u>	June 1987	Dyer et al.
<u>4673993</u>	June 1987	McCaughey
<u>4684756</u>	August 1987	Derr, Jr. et al.
<u>4686313</u>	August 1987	Bell et al.
<u>4717702</u>	January 1988	Beuther et al.
<u>4729981</u>	March 1988	Kobylinski et al.
<u>4738939</u>	April 1988	Boyle
<u>4788222</u>	November 1988	Rice et al.
<u>4822824</u>	April 1989	Iglesia et al.
<u>4863890</u>	September 1989	Koll
<u>4872970</u>	October 1989	Boyle
<u>4880763</u>	November 1989	Eri et al.
<u>4908341</u>	March 1990	Pruden et al.
<u>4910227</u>	March 1990	Brown et al.
<u>4978689</u>	December 1990	Bell et al.
<u>4992406</u>	February 1991	Mauldin et al.
<u>5023277</u>	June 1991	McAteer
<u>5028634</u>	July 1991	Fiato
<u>5036032</u>	July 1991	Iglesia et al.
<u>5070064</u>	December 1991	Hsu et al.
<u>5102851</u>	April 1992	Eri et al.
<u>5102852</u>	April 1992	Hung et al.
<u>5116800</u>	May 1992	Williamson et al.
<u>5140050</u>	August 1992	Mauldin et al.
<u>5157054</u>	October 1992	Herbolzheimer et al.
<u>5162284</u>	November 1992	Soled et al.
<u>5206202</u>	April 1993	Lachman et al.
<u>5248701</u>	September 1993	Soled et al.
<u>5252613</u>	October 1993	Chang et al.
<u>5258411</u>	November 1993	Behrmann et al.
<u>5260239</u>	November 1993	Hsis
<u>5268344</u>	December 1993	Pedrick et al.
<u>5283216</u>	February 1994	Mitchell
<u>5288673</u>	February 1994	Behrmann et al.
<u>5292705</u>	March 1994	Mitchell
<u>5324335</u>	June 1994	Benham et al.

<u>5348982</u>	September 1994	Herbolzheimer et al.	
<u>5356845</u>	October 1994	Clavenna et al.	
<u>5382748</u>	January 1995	Behrmann et al.	
<u>5384336</u>	January 1995	Koros	
<u>5389690</u>	February 1995	Mitchell	
<u>5407644</u>	April 1995	Rytter et al.	
<u>5411927</u>	May 1995	Choudhary et al.	
<u>5422375</u>	June 1995	Rytter et al.	
<u>5424264</u>	June 1995	Richard et al.	
<u>5430219</u>	July 1995	Sanflipppo et al.	
<u>5461022</u>	October 1995	Dosch et al.	
<u>5484757</u>	January 1996	Szymanski et al.	
<u>5498638</u>	March 1996	Long	
<u>5500449</u>	March 1996	Benham et al.	
<u>5504118</u>	April 1996	Benham et al.	
<u>5506272</u>	April 1996	Benham et al.	
<u>5520890</u>	May 1996	Lorentzen et al.	
<u>5527473</u>	June 1996	Ackerman	
<u>5639798</u>	June 1997	Wilson et al.	
<u>5648312</u>	July 1997	Rivas et al.	
<u>5677257</u>	October 1997	Rivas et al.	
<u>5710093</u>	January 1998	Rivas et al.	
<u>5780381</u>	July 1998	Wilson et al.	502/308

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
0174696B1	March 1986	EP	
0178008B1	April 1986	EP	
0454256B1	October 1991	EP	
0533227B1	March 1993	EP	
0579330B1	May 1996	EP	
0736326A1	September 1996	EP	
PCT/US99/02540	August 1999	WO	
Wo 99/61550	December 1999	WO	

OTHER PUBLICATIONS

Blom et al, Cata. Today (1994), 21(2-3), 534-44.*
 Design Parameters Estimations for Bubble Column Reactors May, 1982, vol. 28, pp. 353-379 publication AIChE Journal.
Ruthenium Promotion of Co/Al.sub.2 O.sub.3 Fischer-Tropsch Catalysts, Kogelbauer, et al. Jan. 11, 1996, vol. 160, pp. 125-133, publication Journal of Catalysts.

ART-UNIT: 161

PRIMARY-EXAMINER: Richter; Johann

ASSISTANT-EXAMINER: Parsa; J

ATTY-AGENT-FIRM: Fellers, Snider, Blankenship, Bailey & Tippens

ABSTRACT:

A method for reducing catalyst attrition losses in hydrocarbon synthesis processes conducted in high agitation reaction systems; a method of producing an attrition-resistant catalyst; a catalyst produced by such method; a method of producing an attrition-resistant catalyst support; and a catalyst support produced by such method. The inventive method of reducing catalyst attrition losses comprises the step of reacting a synthesis gas in a high agitation reaction system in the presence of a catalyst. In one aspect, the catalyst preferably comprises a .gamma.-alumina support including an amount of titanium effective for increasing the attrition resistance of the catalyst. In another aspect, the catalyst preferably comprises a .gamma.-alumina support which has been treated, after calcination, with an acidic, aqueous solution. The acidic aqueous solution preferably has a pH of not more than about 5. In another aspect, the catalyst preferably comprises cobalt on a .gamma.-alumina support wherein the cobalt has been applied to the .gamma.-alumina support by totally aqueous, incipient wetness-type impregnation. In another aspect, the catalyst preferably comprises cobalt on a .gamma.-alumina support with an amount of a lanthana promoter effective for increasing the attrition resistance of the catalyst. In another aspect, the catalyst preferably comprises a .gamma.-alumina support produced from boehmite having a crystallite size, in the 021 plane, in the range of from about 30 to about 55 .ANG.ngstrons. In another aspect, the inventive method of producing an attrition-resistant catalyst comprises the step of treating a .gamma.-alumina support, after calcination of and before adding catalytic material to the support, with an acidic solution effective for increasing the attrition resistance of the catalyst. In another aspect, the inventive method of producing an attrition-resistant catalyst support comprises the step of treating calcined .gamma.-alumina with an acidic, aqueous solution effective for increasing the attrition resistance of the .gamma.-alumina.

67 Claims, 5 Drawing figures

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	NUMC	Draw D
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☐ 16. Document ID: US 6255358 B1

L10: Entry 16 of 22

File: USPT

Jul 3, 2001

US-PAT-NO: 6255358

DOCUMENT-IDENTIFIER: US 6255358 B1

TITLE: Highly active Fischer-Tropsch synthesis using doped, thermally stable catalyst support

DATE-ISSUED: July 3, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Singleton; Alan H.	Baden	PA		
Oukaci; Rachid	Gibsonia	PA		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE	CODE
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Energy International Corporation Pittsburgh PA

02

APPL-NO: 09/ 528163 [PALM]

DATE FILED: March 17, 2000

INT-CL: [07] C07 C 27/00, B01 J 23/02, B01 J 23/20

US-CL-ISSUED: 518/715; 518/700, 518/717, 502/340, 502/354

US-CL-CURRENT: 518/715; 502/340, 502/354, 518/700, 518/717

FIELD-OF-SEARCH: 518/700, 518/715, 518/717, 502/340, 502/354

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<u>4423265</u>	December 1983	Chu et al.	
<u>4670472</u>	June 1987	Dyer et al.	
<u>4684756</u>	August 1987	Derr, Jr. et al.	
<u>4788222</u>	November 1988	Rice et al.	
<u>5157054</u>	October 1992	Herbolzheimer et al.	
<u>5248701</u>	September 1993	Soled et al.	
<u>5252613</u>	October 1993	Chang et al.	
<u>5324335</u>	June 1994	Benham et al.	
<u>5348982</u>	September 1994	Herbolzheimer et al.	
<u>5498638</u>	March 1996	Long	
<u>5527473</u>	June 1996	Ackerman	
<u>5939350</u>	August 1999	Singleton et al.	502/230

OTHER PUBLICATIONS

R. Gaugin, M. Graulier, and D. Papee, Thermally Stable Carriers, Advances in Chemistry Series, vol. 143, p. 147 (1975).

Schwaller et al, Ann. Chim.(Paris) (Mar. 1989), 14(3), 209-219.

ART-UNIT: 161

PRIMARY-EXAMINER: Richter; Johann

ASSISTANT-EXAMINER: Parsa; J.

ATTY-AGENT-FIRM: Fellers, Snider, Blankenship, Bailey, & Tippens

ABSTRACT:

A method of conducting hydrocarbon synthesis and a highly stable cobalt on alumina catalyst therefor. The inventive method comprises the step of reacting a synthesis gas in a slurry bubble column reactor in the presence of the catalyst. The catalyst comprises a .gamma.-alumina support doped with an amount of lanthana oxide, barium oxide, or a combination thereof effective for increasing the thermal stability of the catalyst in the slurry bubble column reacting system while maintaining or increasing the activity of the catalyst.

15 Claims, 2 Drawing figures

Full	Title	Citation	Front	Review	Classification	Date	Reference		Claims	KMHC	Draw D
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☐ 17. Document ID: US 6191066 B1

L10: Entry 17 of 22

File: USPT

Feb 20, 2001

US-PAT-NO: 6191066

DOCUMENT-IDENTIFIER: US 6191066 B1

TITLE: Fischer-Tropsch activity for non-promoted cobalt-on-alumina catalysts

DATE-ISSUED: February 20, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Singleton; Alan H.	Baden	PA		
Oukaci; Rachid	Gibsonia	PA		
Goodwin; James G.	Gibsonia	PA		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Energy International Corporation	Pittsburgh	PA			02

APPL-NO: 09/ 320327 [PALM]

DATE FILED: May 26, 1999

PARENT-CASE:

This application claims the benefit of U.S. provisional patent application Serial No. 60/086,846, filed May 27, 1998.

INT-CL: [07] B01 J 23/00, B01 J 23/40, B01 J 23/56, B01 J 23/58

US-CL-ISSUED: 502/332; 502/303, 502/325, 502/326, 502/327, 502/330, 502/350

US-CL-CURRENT: 502/332; 502/303, 502/325, 502/326, 502/327, 502/330, 502/350

FIELD-OF-SEARCH: 502/325-327, 502/330, 502/332, 502/350, 502/303

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<u>2393909</u>	January 1946	Johnson	260/449.6
<u>2515245</u>	July 1950	Mattox	252/417
<u>2540109</u>	February 1951	Friedman	260/449.6
<u>2544574</u>	March 1951	Walker et al.	260/449.5
<u>2598186</u>	May 1952	Mayland	260/449.6
<u>2605234</u>	July 1952	Friedman	252/411

<u>2608568</u>	August 1952	Hogan et al.	260/449.6
<u>2620313</u>	December 1952	Odell	252/417
<u>2632015</u>	March 1953	Kratzer	260/449.6
<u>2635110</u>	April 1953	Watson	260/449.6
<u>2661338</u>	December 1953	Lanning	252/417
<u>2662912</u>	December 1953	Martin	260/449.6
<u>2735802</u>	February 1956	Jahnig	196/52
<u>2775607</u>	December 1956	Kolbel et al.	260/449.6
<u>2852350</u>	September 1958	Kolbel et al.	23/288
<u>3617517</u>	November 1971	Rashkin	208/136
<u>3943052</u>	March 1976	Kmak et al.	208/140
<u>3966586</u>	June 1976	Owen et al.	208/120
<u>3988263</u>	October 1976	Hansford	252/466J
<u>4079072</u>	March 1978	Finch	260/449M
<u>4088671</u>	May 1978	Kobylinski	260/449.6R
<u>4090949</u>	May 1978	Owen et al.	208/78
<u>4133841</u>	January 1979	Cosyns et al.	260/676R
<u>4134860</u>	January 1979	Hindin et al.	252/466
<u>4191664</u>	March 1980	McArthur	252/466J
<u>4207208</u>	June 1980	Lucki et al.	252/455Z
<u>4208191</u>	June 1980	Sze	48/210
<u>4218388</u>	August 1980	Schaper et al.	260/449R
<u>4219445</u>	August 1980	Finch	252/443
<u>4235754</u>	November 1980	Chester	252/455Z
<u>4252736</u>	February 1981	Haag et al.	260/450
<u>4260518</u>	April 1981	Katzer et al.	252/411S
<u>4279830</u>	July 1981	Haag et al.	518/700
<u>4385193</u>	May 1983	Bijwaard et al.	585/310
<u>4403044</u>	September 1983	Post et al.	518/714
<u>4423265</u>	December 1983	Chu et al.	585/322
<u>4433065</u>	February 1984	van der Burgt et al.	518/703
<u>4477595</u>	October 1984	Madon	518/715
<u>4499209</u>	February 1985	Hoek et al.	518/707
<u>4523047</u>	June 1985	Chester et al.	585/322
<u>4548912</u>	October 1985	Hettinger et al.	502/68
<u>4565831</u>	January 1986	Wright et al.	518/700
<u>4567205</u>	January 1986	Arcuri et al.	518/725
<u>4585798</u>	April 1986	Beuther et al.	518/715
<u>4595703</u>	June 1986	Payne et al.	518/715
<u>4605676</u>	August 1986	Kobylinski et al.	518/700
<u>4605678</u>	August 1986	Brennan et al.	518/700
<u>4605679</u>	August 1986	Kobylinski et al.	518/700
<u>4606811</u>	August 1986	Hettinger	208/108
<u>4619910</u>	October 1986	Dyer et al.	502/336
<u>4637993</u>	January 1987	van Erp et al.	502/242
<u>4663305</u>	May 1987	Mauldin et al.	502/304
<u>4670472</u>	June 1987	Dyer et al.	518/700

<u>4673993</u>	June 1987	McCaughey	360/79
<u>4684756</u>	August 1987	Derr, Jr. et al.	585/330
<u>4686313</u>	August 1987	Bell et al.	585/327
<u>4717702</u>	January 1988	Beuther et al.	502/303
<u>4738939</u>	April 1988	Boyle	502/37
<u>4748145</u>	May 1988	Wood et al.	502/332
<u>4788222</u>	November 1988	Rice et al.	518/700
<u>4801573</u>	January 1989	Eri et al.	502/302
<u>4822824</u>	April 1989	Iglesia et al.	518/709
<u>4863890</u>	September 1989	Koll	562/230
<u>4872970</u>	October 1989	Boyle	208/140
<u>4880763</u>	November 1989	Eri et al.	502/302
<u>4908341</u>	March 1990	Pruden et al.	502/30
<u>4910227</u>	March 1990	Brown et al.	518/700
<u>4977126</u>	December 1990	Mauldin et al.	502/242
<u>4978689</u>	December 1990	Bell et al.	518/709
<u>4992406</u>	February 1991	Mauldin et al.	502/304
<u>5023277</u>	June 1991	McAteer	518/715
<u>5028634</u>	July 1991	Fiato	518/707
<u>5036032</u>	July 1991	Iglesia et al.	502/260
<u>5070064</u>	December 1991	Hsu et al.	502/325
<u>5102851</u>	April 1992	Eri et al.	502/302
<u>5102852</u>	April 1992	Hung et al.	502/314
<u>5116800</u>	May 1992	Williamson et al.	502/303
<u>5116879</u>	May 1992	Eri et al.	518/716
<u>5140050</u>	August 1992	Mauldin et al.	518/715
<u>5157054</u>	October 1992	Herbolzheimer et al.	518/700
<u>5162284</u>	November 1992	Soled et al.	502/324
<u>5206202</u>	April 1993	Lachman et al.	502/216
<u>5248701</u>	September 1993	Soled et al.	518/700
<u>5252613</u>	October 1993	Chang et al.	518/700
<u>5258411</u>	November 1993	Behrmann et al.	518/715
<u>5260239</u>	November 1993	Hsia	502/30
<u>5268344</u>	December 1993	Pedrick et al.	502/30
<u>5283216</u>	February 1994	Mitchell	502/30
<u>5286323</u>	February 1994	Bagley	156/89
<u>5288673</u>	February 1994	Behrmann et al.	502/30
<u>5292705</u>	March 1994	Mitchell	502/325
<u>5324335</u>	June 1994	Benham et al.	44/452
<u>5348982</u>	September 1994	Herbolzheimer et al.	518/700
<u>5356845</u>	October 1994	Clavenna et al.	502/21
<u>5382748</u>	January 1995	Behrmann et al.	585/899
<u>5384336</u>	January 1995	Koros	518/700
<u>5389690</u>	February 1995	Mitchell	518/700
<u>5407644</u>	April 1995	Rytter et al.	422/147
<u>5411927</u>	May 1995	Choudhary et al.	502/302
<u>5422375</u>	June 1995	Rytter et al.	518/700

<u>5424264</u>	June 1995	Richard et al.	502/261
<u>5430219</u>	July 1995	Sanfilippo et al.	585/659
<u>5461022</u>	October 1995	Dosch et al.	502/242
<u>5484757</u>	January 1996	Szymanski et al.	502/439
<u>5498638</u>	March 1996	Long	518/706
<u>5500449</u>	March 1996	Benham et al.	518/700
<u>5504118</u>	April 1996	Benham et al.	518/719
<u>5506272</u>	April 1996	Benham et al.	518/700
<u>5520890</u>	May 1996	Lorentzen et al.	422/197
<u>5527473</u>	June 1996	Ackerman	210/767
<u>5639798</u>	June 1997	Wilson et al.	518/714
<u>5648312</u>	July 1997	Rivas et al.	502/325
<u>5677257</u>	October 1997	Rivas et al.	502/178
<u>5710093</u>	January 1998	Rivas et al.	502/439
<u>5733839</u>	March 1998	Espinoza et al.	502/336
<u>5783607</u>	July 1998	Chaumette et al.	502/332
<u>5856365</u>	January 1999	Zennaro et al.	518/715
<u>5939350</u>	August 1999	Singleton et al.	502/230
<u>5958985</u>	September 1999	Geerlings et al.	518/700
<u>5962367</u>	October 1999	Shen et al.	502/439
<u>6100304</u>	August 2000	Singleton et al.	518/715

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
174696B1	March 1986	EP	
178008B1	April 1986	EP	
0 313 375	April 1989	EP	
454256B1	October 1991	EP	
0 533 227	March 1993	EP	
533227B1	March 1993	EP	
579330B1	May 1996	EP	
736326A1	September 1996	EP	
92 06784	April 1992	WO	

OTHER PUBLICATIONS

"Design Parameters Estimations for Bubble Column Reactors", AlChE Journal (vol. 28, No. 3) May. 1982, pp. 353-379.

"Ruthenium Promotion of Co/Al.sub.2 O.sub.3 Fischer-tROPSCH CATALYSTS", by Kogelbauer, et al., Journal of Catalysts, Jan. 11, 1996, vol. 160, pp. 125-133.

ART-UNIT: 175

PRIMARY-EXAMINER: Bell; Mark L.

ASSISTANT-EXAMINER: Hailey; Patricia L.

ATTY-AGENT-FIRM: Fellers, Snider, Blakenship, Bailey and Tippens

ABSTRACT:

Cobalt catalysts, and processes employing these inventive catalysts, for hydrocarbon synthesis. The inventive catalyst comprises cobalt on an alumina support and is not promoted with any noble or near noble metals. In one aspect of the invention, the alumina support preferably includes a dopant in an amount effective for increasing the activity of the inventive catalyst. The dopant is preferably a titanium dopant. In another aspect of the invention, the cobalt catalyst is preferably reduced in the presence of hydrogen at a water vapor partial pressure effective to increase the activity of the cobalt catalyst for hydrocarbon synthesis. The water vapor partial pressure is preferably in the range of from 0 to about 0.1 atmospheres.

16 Claims, 1 Drawing figures

Full	Title	Citation	Front	Review	Classification	Date	Reference			Claims	KWMC	Draw D
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☐ 18. Document ID: US 5116879 A

L10: Entry 18 of 22

File: USPT

May 26, 1992

US-PAT-NO: 5116879

DOCUMENT-IDENTIFIER: US 5116879 A

**** See image for Certificate of Correction ****

TITLE: Process using a supported catalyst for hydrocarbon synthesis

DATE-ISSUED: May 26, 1992

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Eri; Sigrid	Trondheim			NO
Goodwin, Jr.; James G.	Pittsburgh	PA		
Marcelin; George	Pittsburgh	PA		
Riis; Trygve	Oslo			NO

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE	CODE
Den norske stats oljeselskap A.S.	Stavanger			NO		03

APPL-NO: 07/ 590430 [PALM]

DATE FILED: September 28, 1990

PARENT-CASE:

This is a divisional application of U.S. application Ser. No. 07/290,936 filed Dec. 28, 1988.

INT-CL: [05] C07C 1/04

US-CL-ISSUED: 518/716; 518/715

US-CL-CURRENT: 518/716; 518/715

FIELD-OF-SEARCH: 518/715, 518/718

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<u>3988344</u>	October 1976	Nakaoji	
<u>4088671</u>	September 1978	Kobylinski	
<u>4390734</u>	June 1983	Knifton	
<u>4396539</u>	August 1983	Sapienza et al.	
<u>4568663</u>	February 1986	Mauldin	
<u>4595703</u>	June 1986	Payne et al.	
<u>4801573</u>	January 1989	Eri et al.	
<u>4857559</u>	August 1989	Eri et al.	

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
221598	October 1986	EP	

OTHER PUBLICATIONS

H. Pichler, Advances in Catalysis, vol. IV (1952), pp. 271-272, 299-306.
 M. A. Vannice, "The Catalytic Synthesis of Hydrocarbons from H₂/CO Mixtures over Group VIII Metals", Journal of Catalysis, 50, pp. 228-236.
 Catalysis, vol. IV, Reinhold Publishing Co., (1956) pp. 29-33, 46-64.
 M. A. Vannice, "Titania Supported Metals as CO Hydrogenation Catalysts" Journal of Catalysis, 74, 199 (1982).

ART-UNIT: 126

PRIMARY-EXAMINER: Mars; Howard T.

ATTY-AGENT-FIRM: Kirkpatrick & Lockhart

ABSTRACT:

A process for converting synthesis gas, a mixture of hydrogen and carbon monoxide, into a mixture of predominately paraffinic hydrocarbons using a catalyst which includes catalytically active amounts of cobalt and a loading-insensitive second metal selected from the group consisting of platinum, iridium, rhodium and mixtures thereof, composited on an alumina support. The finished catalyst exhibits a positive x-ray diffraction pattern. A metal oxide promoter may also be added.

3 Claims, 10 Drawing figures

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	Know	Draw	Da

☐ 19. Document ID: US 5102851 A

L10: Entry 19 of 22

File: USPT

Apr 7, 1992

US-PAT-NO: 5102851

DOCUMENT-IDENTIFIER: US 5102851 A

**** See image for Certificate of Correction ****

TITLE: Supported catalyst for hydrocarbon synthesis

DATE-ISSUED: April 7, 1992

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Eri; Sigrid	Trondheim			NO
Goodwin, Jr.; James G.	Pittsburgh	PA		
Marcelin; George	Pittsburgh	PA		
Riis; Trygve	Oslo			NO

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE	CODE
Den norske stats oljeselskap a.s.	Stavanger			NO		03

APPL-NO: 07/ 290936 [PALM]

DATE FILED: December 28, 1988

INT-CL: [05] B01J 21/04, B01J 23/10, B01J 23/89

US-CL-ISSUED: 502/302; 502/327, 518/715, 518/716

US-CL-CURRENT: 502/302; 502/327, 518/715, 518/716

FIELD-OF-SEARCH: 502/303, 502/327, 502/324, 502/302, 502/304, 518/715, 518/716

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<u>4088671</u>	May 1978	Kobylinski	260/449.6R
<u>4381257</u>	April 1983	Antos	502/327
<u>4390734</u>	June 1983	Knifton	568/678
<u>4396539</u>	August 1983	Sapienza et al.	252/455R
<u>4568663</u>	February 1986	Mauldin	502/325
<u>4595703</u>	June 1986	Payne et al.	518/715

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
221598	May 1987	EP	502/324
63-23742	February 1988	JP	502/327
345947	July 1972	SU	502/327
600765	January 1982	SU	

OTHER PUBLICATIONS

H. Pichler, Advances in Catalysis, vol. IV, (1952) pp. 299-306.
 M. A. Vannice, "The Catalytic Synthesis of Hydrocarbons from H.sub.2 /CO Mixtures over Group VIII Metals", Journal of Catalysis, 50, pp. 228-236.
 Catalysis, vol. IV, Reinhold Publishing Co. (1956) pp. 29-64.
 M. A. Vannice, "Titania Supported Metals as CO Hydrogenation Catalysts" Journal of Catalysis, 74, 199 (1982).

ART-UNIT: 116

PRIMARY-EXAMINER: Shine; W. J.

ATTY-AGENT-FIRM: Kirkpatrick & Lockhart

ABSTRACT:

A catalyst for converting synthesis gas, a mixture of hydrogen and carbon monoxide, into a mixture of predominately paraffinic hydrocarbons. The catalyst includes catalytically active amounts of cobalt and a loading-insensitive second metal selected from the group consisting of platinum, iridium, rhodium and mixtures thereof, composited on an alumina support. The finished catalyst exhibits a positive x-ray diffraction pattern. A metal oxide promoter may also be added.

15 Claims, 10 Drawing figures

Full	Title	Citation	Front	Review	Classification	Date	Reference			Claims	KNOC	Draw. De
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☐ 20. Document ID: US 4880763 A

L10: Entry 20 of 22

File: USPT

Nov 14, 1989

US-PAT-NO: 4880763

DOCUMENT-IDENTIFIER: US 4880763 A

**** See image for Certificate of Correction ****

TITLE: Catalyst for production of hydrocarbons

DATE-ISSUED: November 14, 1989

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Eri; Sigrid	Trondheim			NO
Goodwin, Jr.; James G.	Pittsburgh	PA		
Marcelin; George	Pittsburgh	PA		
Riis; Trygve	Oslo			NO

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE	CODE
Den norske stats oljeselskap a.s.				NO		03

APPL-NO: 07/ 259232 [PALM]

DATE FILED: October 18, 1988

PARENT-CASE:

BACKGROUND OF THE INVENTION This application is a continuation-in-part of Ser. No. 113,095, filed Oct. 23, 1987, now U.S. Pat. No. 4,801,573.

INT-CL: [04] B01J 21/04, B01J 23/04, B01J 23/36

US-CL-ISSUED: 502/302; 502/303, 502/304, 502/324, 502/328, 502/330, 518/717

US-CL-CURRENT: 502/302; 502/303, 502/304, 502/324, 502/328, 502/330, 518/717

FIELD-OF-SEARCH: 502/302, 502/303, 502/304, 502/324, 502/328, 502/330, 518/717

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<u>3389965</u>	June 1968	Ruiter et al.	502/332 X
<u>4243558</u>	January 1981	Antos	502/330 X
<u>4568663</u>	February 1986	Mauldin	518/715 X
<u>4613624</u>	September 1986	Beuther et al.	518/715

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
48-66086	September 1973	JP	502/332
468649	April 1975	SU	502/332
610558	June 1978	SU	502/332

ART-UNIT: 116

PRIMARY-EXAMINER: Shine; W. J.

ATTY-AGENT-FIRM: Kirkpatrick & Lockhart

ABSTRACT:

A catalyst for converting synthesis gas composed of hydrogen and carbon monoxide to hydrocarbons. The catalyst includes cobalt in catalytically active amounts up to about 60 wt % of the catalyst, rhenium in amounts of about 0.5 to 50 wt % of the cobalt content of the catalyst and an alkali in amounts ranging from about 0.5 to 5 atom percent of the cobalt content of the catalyst, supported on alumina. A metal oxide promoter may be added.

15 Claims, 4 Drawing figures

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	FIGS	Draw Dg
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☐ 21. Document ID: US 4857559 A

L10: Entry 21 of 22

File: USPT

Aug 15, 1989

US-PAT-NO: 4857559

DOCUMENT-IDENTIFIER: US 4857559 A

**** See image for Certificate of Correction ****

TITLE: Process for production of hydrocarbons

DATE-ISSUED: August 15, 1989

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Eri; Sigrid	Trondheim			NO
Goodwin, Jr.; James G.	Pittsburgh	PA		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Gas-To-Oil, Inc.	Pittsburgh	PA			02

APPL-NO: 07/ 259221 [PALM]

DATE FILED: October 18, 1988

PARENT-CASE:

This application is a continuation-in-part of Ser. No. 113,095, filed Oct. 23, 1987, now U.S. Pat. No. 4,801,573.

INT-CL: [04] C07C 1/04, C07C 1/06

US-CL-ISSUED: 518/700; 518/715

US-CL-CURRENT: 518/700; 518/715

FIELD-OF-SEARCH: 518/700, 518/715

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<u>4568663</u>	February 1986	Mauldin	518/715

ART-UNIT: 126

PRIMARY-EXAMINER: Mars; Howard T.

ATTY-AGENT-FIRM: Kirkpatrick & Lockhart

ABSTRACT:

A process for converting synthesis gas composed of hydrogen and carbon monoxide to hydrocarbons. The process includes the step of contacting at reaction conditions a synthesis gas feed to a catalyst which includes cobalt in catalytically active amounts up to about 60 wt % of the catalyst and rhenium in catalytically active amounts of about 0.5 to 50 wt % of the cobalt content of the catalyst supported on alumina. A metal oxide promoter may be added.

16 Claims, 4 Drawing figures

Full	Title	Citation	Front	Review	Classification	Date	Reference			Claims	KAAC	Draw D
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☐ 22. Document ID: US 4801573 A

L10: Entry 22 of 22

File: USPT

Jan 31, 1989

US-PAT-NO: 4801573

DOCUMENT-IDENTIFIER: US 4801573 A

**** See image for Certificate of Correction ****

TITLE: Catalyst for production of hydrocarbons

DATE-ISSUED: January 31, 1989

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Eri; Sigrid	Trondheim			NO
Goodwin, Jr.; James G.	Pittsburgh	PA		
Marcelin; George	Pittsburgh	PA		
Riis; Trygve	Oslo			NO

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE	CODE
501 Den Norske Stats Oljeselskap A.S.	Trondheim			NO		03

APPL-NO: 07/ 113095 [PALM]

DATE FILED: October 23, 1987

INT-CL: [04] B01J 21/04, B01J 23/68

US-CL-ISSUED: 502/302; 502/303, 502/304, 502/324, 502/328, 502/332, 518/715

US-CL-CURRENT: 502/302; 502/303, 502/304, 502/324, 502/328, 502/332, 518/700,
518/715

FIELD-OF-SEARCH: 502/332, 502/302, 502/303, 502/304, 502/324, 502/328, 518/715

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
<u>3389965</u>	June 1968	Ruiter et al.	502/332 X
<u>4568663</u>	February 1986	Mauldin	518/715 X
<u>4613624</u>	September 1986	Beuther et al.	518/715

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
48-66086	September 1973	JP	502/332
468649	April 1975	SU	502/332
610558	June 1978	SU	502/332

ART-UNIT: 116

PRIMARY-EXAMINER: Shine; W. J.

ATTY-AGENT-FIRM: Kirkpatrick & Lockhart

ABSTRACT:

A catalyst for converting synthesis gas composed of hydrogen and carbon monoxide to hydrocarbons. The catalyst includes cobalt in catalytically active amounts up to about 60 wt % of the catalyst and rhenium in catalytically active amounts of about 0.5 to 50 wt % of the cobalt content of the catalyst supported on alumina. A metal oxide promoter may be added.

13 Claims, 2 Drawing figures

Full	Title	Citation	Front	Review	Classification	Date	Reference		Claims	INMC	Draw. De
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Clear	Generate Collection	Print	Fwd Refs	Bkwd Refs	Generate OACS
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Term	Documents
PARTICLE	831797
PARTICLES	1158906
SIZE	3404158
SISE	506
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SIZES	751523
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(L9 AND PARTICLE SIZE).PGPB,USPT,USOC,EPAB,JPAB,DWPI.	22

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